Willow coppice as a riparian buffer strip

Joe Livingstone [1*], Chris Johnston[2], Gary Lyons[2], Simon Murray[3], Aoife Foley[1], Mark Taggart[4], Beatrice Smyth[1]
[1] Queen's University Belfast, School of Mechanical and Aerospace Engineering, [2] Agri-Food and Biosciences Institute, Large Park, Hillsborough
[3] Queen's University Belfast, School of Chemistry and Chemical Engineering, [4] University of the Highland and Islands
*Contact email: dlivingstone04@qub.ac.uk

Aim: To assess the effectiveness of SRC willow as a riparian buffer strip using LCA

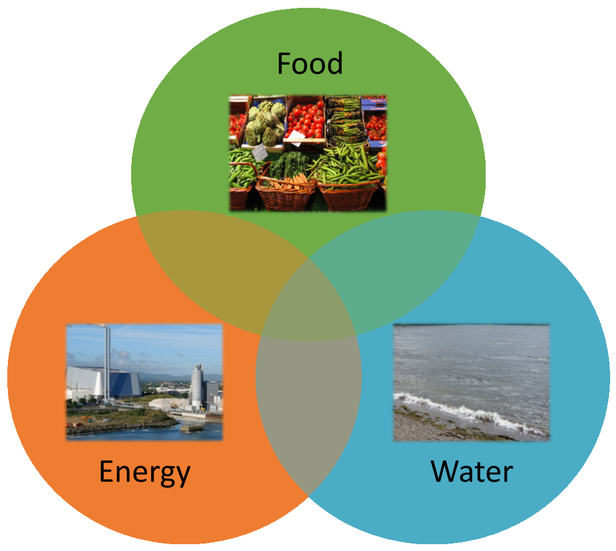
Introduction

Understanding the Food-Energy-Water nexus (FEW) is vital to meeting the Sustainable Development Goals set out by the United Nations in 2015.

As agricultural intensity increases across Europe there has been a growing concern over water quality.

The EU average for water bodies not achieving 'Good or Better' status is 47% [1].

Water pollution is often the result of nutrients from agricultural run-off, mainly caused by the over use of fertilizer.



Strategically positioned willow coppice has been suggested as a way to reduce strain on the FEW nexus [2]. The aim of the system is to reduce agricultural run-off, removing nutrients from the agricultural system, and provide a source of renewable energy.

The effectiveness of such a system is currently uncertain and must be determined before wide spread implementation can be considered.

To do this LCA will be carried out at a pilot site at the Agri-Food and Biosciences Institute (AFBI) in Hillsborough Northern Ireland.

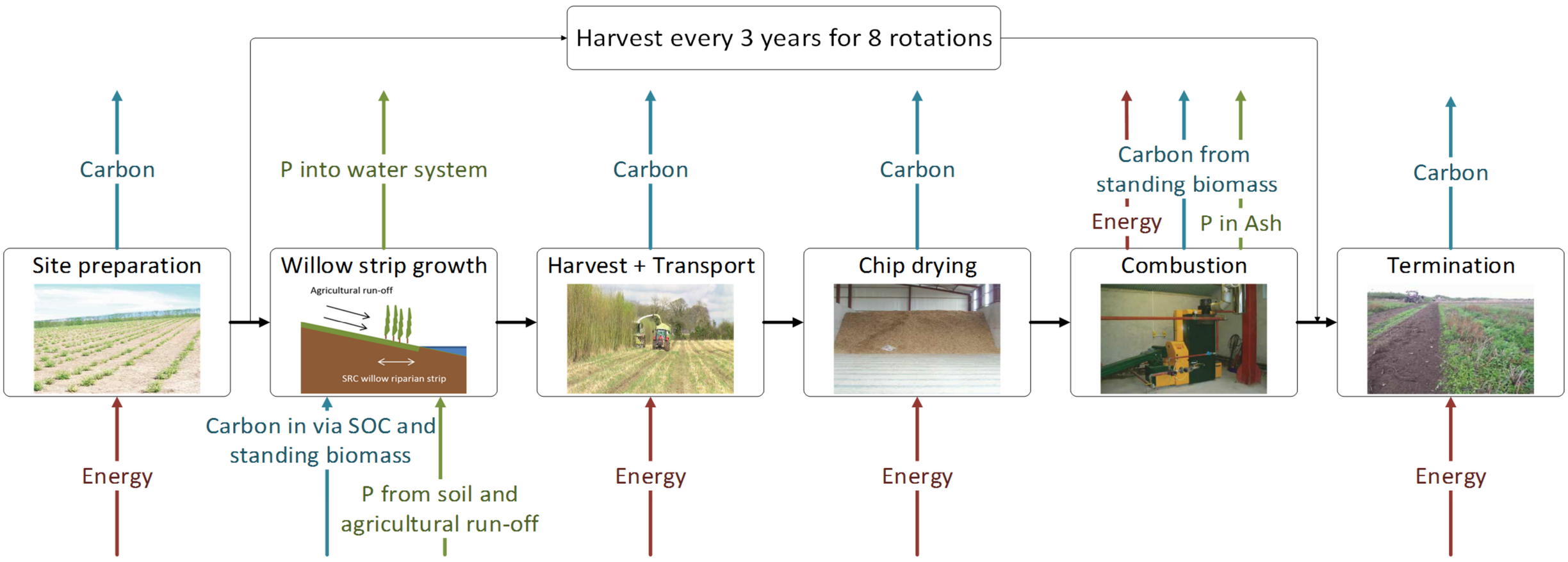


Fig 1. Willow coppice system under investigation. The site preparation stage includes nursery activities, ploughing, herbicide spraying and planting of the SRC willow.

Methodology

The site consists of willow buffer and unfertilised grassland plots trialled in triplicate (Fig. 2)

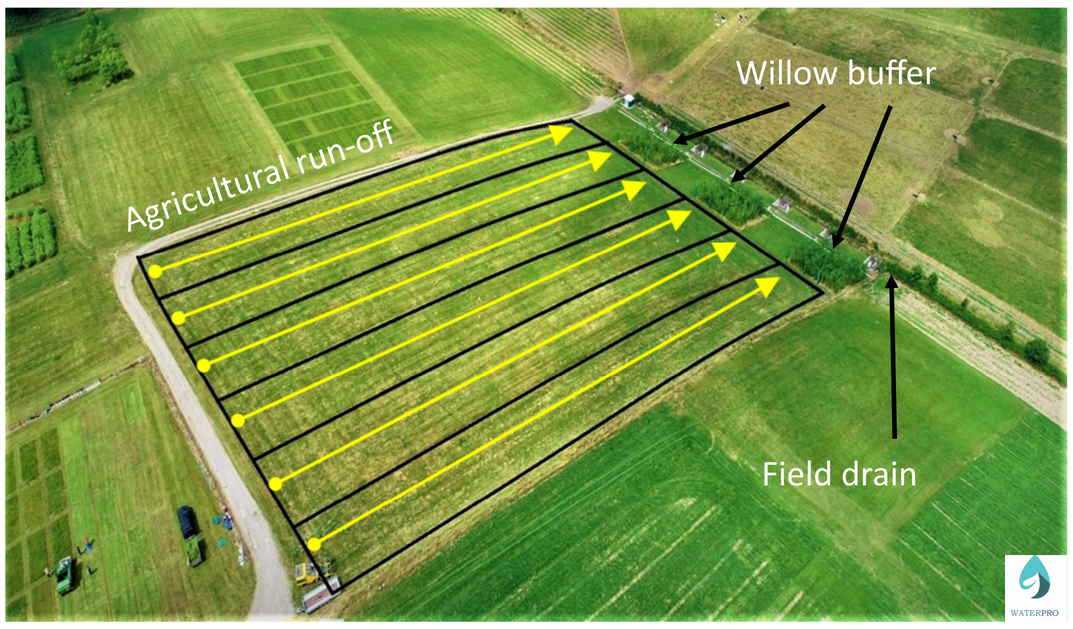


Fig. 2 Aerial view of the ongoing field trials at AFBI Large Park Hillsborough.

The site will be assessed to determine the effectiveness the system in regards to the impact categories:

- Global warming potential (GWP)
- Eutrophication potential (EP)
- Energy ratio (ER)

The study will follow the principles described in the ISO standard 140 44 [3].
The use of LCA has several advantages and limitations as described in Table 1.

Table 1- Advantages and limitations of LCA

Advantages	Limitations
LCA highlights environmental impacts from a cradle-to-grave perspective [4].	LCA is static in nature, ignoring the effect of the timing of emissions.
LCA has been applied extensively to willow coppice in the literature.	LCA does not consider spatial variations.
LCA can identify priority areas where improvements will be most significant for reducing environmental impacts [3].	LCA does not consider temporal variations.
LCA is recognised by the European Commission as a useful tool for informing policy [5].	Agricultural systems are heavily affected by temporal and spatial variations. Ignoring these variations significantly reduces the reliability of results [6].

Conclusions

The use of SRC willow as a riparian buffer strip can result in several positive environmental impacts:

- Protection of water resources
- Improvements in the sustainability of agriculture
- The provision of renewable energy
- A reduction in GHGs

The implementation of SRC willow is limited by land availability and proximity to suitable conversion technologies.

Further work

Upon completion of the initial LCA of the system a novel LCA technique will be developed to incorporate the spatial and temporal variations of the system. Throughout literature this has been cited as a key way to improve the reliability of LCA results.

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Acknowledgments

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